One in six men is diagnosed with prostate cancer in his life time, and about one in two men is confronted with prostate cancer diagnostics. Due to the lack of reliable imaging solutions, prostate-cancer diagnostics is based on twelve needle biopsies that are taken blindly. This research proves the feasibility of an ultrasound-based strategy for more accurate imaging, enabling image-guided targeting of substantially fewer biopsies and, ultimately, paving the way for non-invasive, reliable and cost-effective diagnostics.

Novel multidimensional algorithms were introduced to generate a 3D map of cancer (micro)vascular markers by analysing the transport of ultrasound contrast agents as a 3D convective-dispersion process. A 3D approach is technically more accurate and facilitates the clinical workflow enabling efficient investigation of the full prostate. To further enhance the imaging accuracy, multiple complementary markers of cancer, related to tissue stiffness, structure, along with (micro)vascular architecture and flow, were combined in a multiparametric fashion.

Automatic combination of these physics-driven parameters through artificial intelligence substantially increased the diagnostic accuracy. Moreover, in collaboration with the AMC and the Martini Clinic in Hamburg, we proved doctors to locate significantly more tumour hotspots using the proposed multiparametric approach compared to individual ultrasound parameters. Further clinical testing is underway.

**Figure 2:** A selection of meaningful parameters derived from three-dimensional contrast-enhanced ultrasound scans. Multiparametric combination of these parameters helps to better distinguish of prostate cancer (arrow). The results were obtained in a 43-patient study at the Second Affiliated Hospital of Zhejiang University, China.

**Figure 3:** Technical framework to automatically analyze different ultrasound techniques and generate single multiparametric images that highlight potential prostate cancer sites. The method was developed in a study with 50 patients at the Martini Clinic, Hamburg.